

COURSE OUTLINE **Majors Biology I (Animal)**

Course Description

BI 120. Majors Biology I (Animal). 5 hours credit. This course will enable the student to develop an understanding of basic molecular chemistry, cell structure and function, molecular and classical genetics, main concepts in animal physiology, and animal behavior. The student will also understand the diversity of life through a survey of the animal kingdom. This course includes 2 one-and-a-half hour lecture periods and 2 two-hour laboratory periods per week.

Course Relevance

Basic concepts of biology are fundamental to understanding the more complex biological processes covered in upper division courses. Mastery of these concepts by taking these courses will increase the student's success. Understanding concepts involved in molecular genetics will help the student decide ethical issues using these technologies. Understanding basic concepts in animal physiology will enable the student to better understand how the human body works.

Required Materials

Mader, S., *Biology* (10th ed.). New York, NY: McGraw-Hill.

Palladino, J. (2000). *Biologylabs-on-line*. San Francisco, CA: Benjamin-Cummings

Learning Outcomes

The intention is for the student to be able to:

1. Describe the relationship of cell structure to specific cellular functions
2. Apply basic principles of genetics to inheritance patterns
3. Apply basic principles of physiology to understanding how the human body works

Learning PACT skills that will be developed and documented in this course

Through the student's involvement in this course, he/she will develop his/her ability in the following PACT skill areas:

Analytical Thinking Skills

1. Critical thinking
 - Through the application of concepts to new situations, students will develop critical thinking skills.

Major Summative Assessment Task(s)

These learning outcomes and the Learning Pact skills will be demonstrated by

1. Designing and executing an experiment that demonstrates a sound scientific process and reporting the results in a scientific paper format

2. Researching a particular group of organisms and making an oral presentation

Course Content

- I. Themes – Key recurring concepts that run throughout this course:
 - A. Molecular basis of life
 - B. Cellular basis of life
 - C. Genetic basis of living processes
 - D. Connection between structure and function
 - E. Homeostasis feedback
 - F. Evolutionary history
- II. Issues –Key areas of conflict that must be understood in order to achieve the intended outcome:
 - A. Balance between the reductionism (molecular/cellular/mechanical) view point and emergent properties as the level of complexity increases
 - B. Relationship between the proximate and ultimate explanations or causes of biological processes
- III. Concepts – Key concepts that must be understood to address the issues:
 - A. Structure and function at the cellular, individual and population levels
 - B. Chemical basis of metabolism, physiological processes, cell respiration and protein synthesis
 - C. Adaptation as a compromise of competing selective pressures
- IV. Skills/Competencies – Actions that are essential to achieve the course outcomes:
 - A. Apply the scientific process, recognize chemical molecules and cell structures
 - B. Describe the classical and molecular basis of genetics
 - C. Describe the structure and physiology of the urinary and respiratory systems
 - D. Describe the structures and physiology of digestive and circulatory systems
 - E. Describe the structure and physiology of the muscular and nervous systems
 - F. Recognize the classification and the significant structures in the following groups

Learning Units

- I. Scientific process, chemistry and cells
 - A. Describe the steps in the scientific process and how each relates to a specific area in a scientific paper
 - B. Describe the differences between a hypothesis, fact and interpretation
 - C. Be able to design an experiment in which you can identify the control, independent and dependent variables, state the hypothesis in a predictive form and null and alternative hypothesis
 - D. Describe the difference between a proximate and ultimate question
 - E. Describe the significant parts of Koch's experiment that proved one species causes one disease
 - F. Describe the importance of verifying that the bacteria were present or absent in the blood used in the injections and in the injected subjects. Describe what was necessary to prove his point conclusively
 - G. Diagram the structural formula from the empirical formula for a given molecule
 - H. Recognize the structural formulas of the following kinds of molecules: glucose, fructose, sucrose, maltose, starch, fat or triglyceride (saturated and unsaturated), amino acid, protein (primary, secondary and tertiary structure), peptide bond and

the structure of nucleic acid and nucleotide

- I. Describe the following cellular parts: cell wall, cell membrane, nucleus, centriole, ribosome, endoplasmic reticulum (smooth and rough), golgi body, mitochondria, chloroplast, flagella, and cilia
- J. Describe the difference between an ionic and covalent bond
- K. Describe the three major points of the cell theory and the significance of each
- L. Describe the direction of flow across a differentially permeable membrane in hypotonic, hypertonic and isotonic solutions
- M. Describe the structure of the cell membrane and the roles the double phospholipid layer and proteins play in its operation
- N. Describe the difference between diffusion and active transport

II. Genetics

- A. Describe the meaning of the terms: chromosome, chromatid, centromere, mitosis, mitotic cell division, cytokinesis, zygotes, and gametes
- B. Describe the major events that occur during the various phases of mitosis
- C. Describe and diagram the major events that occur during meiosis
- D. Describe three major differences between mitosis and meiosis
- E. Describe the difference between homologous and non-homologous chromosomes
- F. Describe the meaning of genotype, phenotype, homozygous, heterozygous, dominant, recessive, allele, gene and co-dominant
- G. Solve genetic problems for crosses between individuals heterozygous for one trait and for two traits
- H. Identify the kinds of gametes the following genotypes can produce: DdTt, DDTt, ddTT
- I. Describe how Mendel's work proves that genes behave as particles
- J. Describe the evidence that Mendel used to derive his Principle of Dominance and Principle of Segregation
- K. Describe the kinds of inheritance that occur for cystic fibrosis, galactosemia, phenylketonuria (PKU), sickle cell anemia and Huntington's Chorea
- L. Describe the inheritance of blood types – ABO
- M. Describe the inheritance of sex in humans
- N. Describe how Down's syndrome occurs and relate this with non-disjunction.
- O. Describe the structure of nucleic acids
- P. Describe the structural differences between DNA and RNA
- Q. Describe how DNA replicates
- R. Describe the steps involved in transcription and translation
- S. Describe the roles or meaning of the following: codon, anticodon, amino acid, protein, messenger RNA, transfer RNA, ribosome, and nucleolus

III. Urinary and respiratory systems

- A. Compare how marine and freshwater fish regulate water and salt balances
- B. Describe the ecological contexts in which ammonia, urea and uric acid are well suited

- C. Describe the function of the ureter, urinary bladder, urethra, urinary pelvis and nephron
- D. Identify and describe the following the function of the following parts of the nephron: glomerulus, Bowman's Capsule, Proximal convoluted tubule, distal convoluted tubule, loop of Henle, and collecting tubule
- E. Compare and contrast the processes of filtration and reabsorption
- F. Describe the role of the loop of Henle, collecting duct and how the antidiuretic hormone control the concentration of urine
- G. Describe how the kidney and breathing function to reduce acidosis
- H. Describe the differences in the reactions and products between aerobic and anaerobic respiration
- I. Describe the events involved inspiration and expiration
- J. Describe how oxygen is transported in the blood and relate the structure of hemoglobin to its function
- K. Describe how carbon dioxide is transported in the blood
- L. Compare how gills, lungs and trachea differ in gas exchange

IV. Digestive and respiratory systems

- A. Recognize the main units of the digestive system in humans and describe the function of each important organ
- B. Describe the flow of blood through the heart naming all the valves, chambers and vessels
- C. Describe the differences in structure and function among capillaries, arteries and veins
- D. Describe how blood pressure is measured and what the numbers represent
- E. Describe the difference antigen and antibody and the relationship of this to the immune system
- F. Describe how a vaccination works

V. Muscular and nervous systems and animal behavior

- A. Describe the structure of the sarcomere in terms of bands and zones and arrangement of actin and myosin fibers
- B. Describe how the sliding filament model works in sarcomere contraction
- C. Describe how the ratchet action interaction between actin and myosin filaments works
- D. Describe the role that calcium ions play in controlling the reaction between actin and myosin filaments
- E. Describe how a nerve impulse translates into calcium ion level changes in the myofibrils
- F. Describe adaptations of skeletal muscles to demands of exercise
- G. Describe the components of the reflex arc and the function of each component
- H. Describe the difference between a sensory and motor neuron, dendrite and axon
- I. Describe the resting potential in terms of an image on an oscilloscope, ion concentrations and membrane function
- J. Describe a nerve impulse in terms of an image on an oscilloscope, ion concentrations and membrane function

- K. Describe what a wave of depolarization means
- L. Describe the steps involved in synaptic transmission
- M. Describe how intensity of a stimulus is transmitted and the role of labeled lines
- N. Describe how the neural structure codes for an adaptive response in the cockroach to potential dangerous stimulus
- O. Describe how the neural structure codes for an adaptive response in the noctuid moth in response to ultrasonic calls of foraging bats

VI. Classification

- A. Porifera
- B. Cnidaria
- C. Platyhelminthines
- D. Nematoda
- E. Rotifera
- F. Annelids
- G. Mollusks
- H. Echinoderms
- I. Arthropods
- J. Chordates (Vertebrates)

Learning Activities

Learning activities will be assigned toward mastery of course concepts, practice of critical thinking skills applied to other situations and study guide exercises. Independent and collaborative activities will be assigned in and outside of class. Examples of activities which contribute to the learning process include the following: instructor lecture, study guide assignments, presentations to class, analysis of activities which illustrate concepts, application of concepts to new situations, exams, quizzes and presentations.

Grade Determination

The student will be graded on performance of quizzes and exams that measure the level of mastery of concepts. The student will also be evaluated on the completion of lab reports, lab exercises, written report and oral presentations, and assessment tasks.